

REMARKS

This application contains claims 1-53. Claims 1, 12, 16, 18, 19, 22-26, 29-35, 38 and 45 have been amended. Claims 1-53 are currently pending in this application.

Amendment to the Specification

The specification has been amended to correct minor typographic and clerical errors and to correct antecedent basis for certain claims as discussed below. Additionally to provide antecedent basis for certain claims, several sections of co-pending, commonly-owned U.S. application 10/358,404 have been introduced into the specification. The composition of the catalyst TDA#2 has been added from page 41, line 1 of the '404 application and several sentences which refer to the use of binders in the catalysts of this invention from page 37, line 28 to page 38, line 2 of the '404 application have been added to the specification of this application. This response is accompanied by a declaration of the undersigned stating that the material entered into the specification by amendment was material that was incorporated by reference herein from the '404 patent application.

None of the amendments to the specification represent the addition of new matter.

Amendments to the Claims

Claim 1 has been amended to recite that the low oxidation activity metal oxide is selected from the group consisting of titania, zirconia, silica, alumina or mixtures thereof. This amendment is supported in the specification on page 13, lines 27-29.

Obvious typographic or clerical errors have been amended in claims 12, 16, 29, 31-35 and 45. In claim 29, the term "85% by weight" was replaced by "75% by weight" which is consistent with the recitation on page 14, lines 22-28, of the specification.

Claims 18, 19, 22-26, 30 and 38 have been amended to improve clarity by correcting Markush language and clerical errors.

None of the amendments to the claims adds new matter to the specification.

Priority/Effective Filing Date

The Office Action alleges that the effective filing date for all claims (claims 1-53) is November 19, 2002. Applicant does not necessarily acquiesce to this allegation, but there is no apparent reason for disputing this issue at this time, since no reference with a date between March 25, 2002 and November 19, 2002 has been cited in a rejection herein.

Objections to the Specification and Drawings

The Abstract has been objected to for improper labeling and for the inclusion of improper recitations under MPEP § 608.01(b) and 37 CFR § 1.72. The undersigned has amended the Abstract as requested obviating this objection.

On pages 5 and 6 of the Office Action a number of minor informalities in the specification are noted. The Cross-Reference to Related Applications on page 1 of the specification has been amended as suggested by the Examiner. Correction of typographic errors noted in claims 1, 12 and 16 have been corrected (see Claims Amendments). The suggested amendment to Figure 3 has been made (see below).

The specification at page 16, line 6 has been corrected to insert "molybdenum oxide." It is clear from the context of the paragraph that the term was inadvertently omitted. The sentence preceding and the sentence following the sentence containing the omission both refer to catalysts containing 0.4% to 6% by weight molybdenum oxide.

The specification at page 32, lines 10-11 has been amended to insert the composition of the catalyst designated "TDA#2." This composition is found in co-pending commonly-owned U.S. application 10/358,404 at page 41, line 1. This U.S. application has been incorporated by reference in the present application particularly for its teachings and descriptions of catalysts (see page 3, lines 23-26). This amendment is accompanied by a declaration executed by the undersigned representative of the Applicant herein that the material that has been introduced in

this amendment is material from the '404 application that was intended to be incorporated by reference.

The specification was objected to for lack of clear antecedent basis for certain claims:

- a. the alpha and gamma alumina recited in claim 17;
- b. the "85% by weight" lower limit in claim 29;
- c. the combinations of weight percentages and oxides in claims 31-34;
- d. the catalyst binder in claims 36 and 37;
- e. the surface area ranges in claim 41;
- f. the catalyst preparation limitations recited in claims 43 and 44.

Claim 29 has been amended to correct an obvious clerical error to change 85% by weight to 75% by weight which is supported by the specification.

The claims as-filed are part of the disclosure and as such amendment of the specification to recite limitations found in claims does not represent the addition of new matter to the specification. The specification in the paragraph bridging pages 13-14 has been amended to add the sentence: "Both alpha alumina and gamma alumina are useful as low oxidation activity metal oxides." This amendment is supported by as-filed claim 17.

The specification at page 14 has been amended to add the following paragraph which is supported by as-filed claims 31-34

Selected catalysts useful for the invention include: those containing from 0.1% to about 10% by weight of an oxide of Mo, an oxide of Nb or both and from about 1% to about 10% by weight of an oxide of Fe, Cu or Co; those comprising about 1 to about 10% by weight copper oxide, about 1 to about 10% by weight niobium oxide, and about 0.1 to about 1% by weight molybdenum oxide with the remainder being titania or a mixture of titania and silica; those comprising about 1 to about 10% by weight iron oxide, about 1 to about 10% by weight niobium oxide, and about 0.1 to about 1% by weight molybdenum oxide with the remainder being titania or a mixture of titania and silica; and those comprising about 1 to about 10% by weight cobalt oxide, about 1 to about 10% by weight niobium oxide, and about 0.1 to about 1% by

weight molybdenum oxide with the remainder being titania or a mixture of titania and silica.

The specification at page 17 in the paragraph starting at line 26 has been amended to insert the sentence: "Catalysts of this invention include those having a surface area ranging from about 50 to about 150 m²/g." This sentence is supported by claim 41.

The specification at page 17 has been amended to insert the following paragraph which is supported by claims 43 and 44.

Catalysts useful in this invention include those prepared by calcining a mixed metal oxide powder at a temperature of about 300°C to 550°C and those prepared by calcining a mixed metal oxide powder at a temperature of about 400°C to 450°C.

The specification at page 16 has been amended to insert the following paragraph which is found in co-pending, commonly-owned U.S. application 10/358,404 at page 37, line 28 to page 38, line 2 which is incorporated by reference herein:

Silica, silica gel or other binders can also be used in the preparation of catalysts of this invention and the exact nature of the binder is unimportant; however, in the preferred formulation, aluminum oxide is avoided to minimize any sulfation reactions that may occur by reaction of the aluminum oxide with SO₂. The amount of binder can vary from 1 wt% to 25 wt% with the preferred amount being 10% of the original weight of the powder mixture (e.g. 10 gm of binder for each 100 gm of mixed powders). Mixed metal oxide catalysts of this invention can comprise up to about 105 by weight of a binder. The preferred binder is silica.

This U.S. application has been incorporated by reference in the present application particularly for its teachings and descriptions of catalysts (see page 3, lines 23-26). This amendment is accompanied by a declaration executed by the undersigned representative of the Applicant herein that the material that has been introduced in this amendment is material from the '404 application that was intended to be incorporated by reference.

It is believed that all of the objections listed above a-f have been obviated by the amendments to the specification and claims. The objections to the specification should be withdrawn.

The Office Action further objects to two instances in the specification that are alleged to be partial incorporation by reference. The undersigned has amended the specification to delete the phrase "to the extent that it is not inconsistent with the disclosure herein." It is believed that these amendments obviate this objection.

The Drawings were objected for several reasons. The Office Action states that the reference character "415" has been used in Figures 1 and 2 to refer to both the "catalytic reactor" and the "Direct Oxidation Reactor." Figures 1 and 2 have been amended to delete text and a text box the include the name "Direct Oxidation Reactor." Element 415 is the catalytic reactor. The Direct Oxidation Reactor on the Figures was intended to refer to several elements in addition to element 415. To avoid confusion the text has been removed from Figures 1 and 2. In Figure 2, the elements within the span of the bracket which is labeled reference number 501 are the components of the "Direct Oxidation Reactor." It is believed that the amendments to the drawings obviate this objection.

On page 6 of the Office Action, the Examiner suggests insertion of the word "Inventive" into the text box labeled 601. This amendment has been made to Figure 3.

The undersigned has submitted "Annotated Sheets" for Figures 1-3 to illustrate the drawing changes in red. Assuming that these changes are acceptable, the undersigned provided "Replacement Sheets" for each of Figures 1-3.

The Rejections

Claims 1, 3-13, 30, 31, 36, 37 and 39-53 are rejected under 35 U.S.C. § 112, first paragraph as non-enabled in the disclosure of the specification. Claim 1 has been amended to recite that the low activation activity metal oxide is selected from the group consisting of titania, zirconia, silica, alumina and mixtures thereof. This amendment is believed to obviate the rejection and withdrawal of the rejection is respectfully requested.

Claims 1-3 and 5-52 are rejected under 35 U.S.C. § 103 (a) as being unpatentable over Srinivas et al. U.S. patent 6,099,819 in view of Audeh U.S. patent 4,786,483. Applicant respectfully traverses this rejection.

The Office Action alleges that the '819 patent teaches methods for treating hydrogen sulfide-containing gas streams which meet all of the material limitations of the rejected claims with the exception that the '819 patent does not teach the simultaneous removal of mercury and hydrogen sulfide. The Office Action further alleges that it would have been obvious to employ the methods and catalysts of the '819 patent to treat natural gas streams.

The '483 patent is characterized as teaching in the Prior Art section of the patent that "gas produced from some natural gas fields contains hydrogen sulfide and small amounts of mercury." The Office Action characterizes the '483 as teaching "that not only was it known in the art that natural gas streams contained both hydrogen sulfide and mercury, but also that it was desirable to remove both in a single step."

The Office Action alleges that in view of the teachings of the '819 and the '483 patent that "it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to have also removed any mercury present therein at the same time." It is further stated that "methods falling within the scope of applicant's claims 1-3 and 5-52 would have obviously resulted ... given the resultant presence of both sulfur and mercury reactants."

The '819 patent teaches catalyst for oxidation of hydrogen sulfide particularly the partial oxidation of hydrogen sulfide to elemental sulfur and water. The catalysts are mixtures of metal oxides containing titanium oxide and one or more metal oxides selected from metal oxides or mixtures of metal oxides of transition metals or lanthanide metals. The patent does not generally teach a combination of low oxidation activity metal oxide with one or more higher oxidation activity catalysts. The patent exemplifies H₂S oxidation in certain gas streams containing water, CO₂, and mixtures of CO₂ and water. Further, as noted in the Office Action, the patent states that the "catalysts of this invention function in the presence of potentially

interfering substances, such as carbon dioxide, water, and hydrocarbons, including methane, benzene, toluene, xylene, among others."

The Office Action alleges that it would have been obvious to employ the catalysts of the '819 patent to treat natural gas. Applicants do not consider this issue to be pertinent to the question of the obviousness of the present claims to methods for simultaneous removal of H₂S and mercury and do not herein agree or disagree with this allegation of the Office Action. The following arguments apply even if it is assumed for the sake of argument that it was obvious to treat natural gas employing the catalysts of the '819 patent.

The '819 patent does not teach or suggest that any of the catalysts disclosed therein function in the presence of mercury and more importantly there is no teaching or suggestion that mercuric sulfide would be formed under the conditions of the methods disclosed and could be removed and condensed with sulfur formed by oxidation of H₂S. In the absence of such a teaching or disclosure, one of ordinary skill in the art would not have been motivated to employ the catalysts of the '819 patent to simultaneously remove sulfur and mercury. One of ordinary skill in the art would at most have been motivated to employ the catalysts as described to oxidize H₂S to sulfur and, if mercury were present in the gas stream, to employ other methods known in the art to remove mercury.

The '483 patent does not cure the deficiencies of the '819 patent. This patent teaches that some (notably not all) natural gas streams contain H₂S and mercury. The '483 patent teaches a method for simultaneous removal of H₂S and mercury by use of peroxomonosulfate alkali salts. The gas is flowed in contact with a granular material impregnated with the salt which reacts with mercury to form mercuric oxide and simultaneously with H₂S to form and deposit elemental sulfur. There is no teaching or suggestion herein that mixed metal catalysts of the '819 patent can function in the presence of mercury and that mercuric sulfide would be formed and condensable under the conditions of the method of the '819 patent.

One of ordinary skill in the art on reviewing the entire teachings of the '819 and '493 patents would not have been motivated to employ the catalysts of the '819

patent to simultaneously remove H₂S and mercury. Rather in view of the teachings of the '493 patent, one of ordinary skill in the art would have employed the more desirable one-step process as taught by the '493, if it was desired to treat a gas stream containing both H₂S and mercury. Alternatively, one of ordinary skill in the art might combine the teachings of the two references employing the catalysts of the '819 and the absorbent material of the '483 patent. However, there is no teaching in either of the references as to how such a combination would be made. In any event, a combination of the methods of these two patents is not what is claimed in Applicant's claims.

Thus, in view of the forgoing, in the absence of any teaching or suggestion that the catalysts and methods of the '819 patent could be employed for simultaneous removal of H₂S and mercury, no prima facie case of obviousness has been made and this rejection should be withdrawn.

Claims 4 and 53 are rejected under 35 U.S.C. § 103 (a) as being unpatentable over Srinivas et al. U.S. patent 6,099,819 in view of Audeh U.S. patent 4,786,483 and further in view of Hass et al. U.S. patent 4,088,743. Applicant respectfully traverses this rejection.

Claims 4 and 53 relates to the treatment of gas streams containing hydrogen, carbon monoxide or mixtures thereof or synthesis gas (a mixture of hydrogen and carbon monoxide).

The Office Action alleges that the '743 patent "establish that the catalytic treatment of gas streams containing not only H₂S, but also hydrogen and/or carbon monoxide, was known in the art."

The deficiencies of the combination of the '819 and the '483 patents have been noted above. The '743 patent does not cure these deficiencies. The '743 patent does not teach or suggest that the catalysts of the '819 patent function in the presence of mercury, does not teach or suggest that mercuric sulfide would be formed under the conditions of the methods and does not teach or suggest that the catalysts of the '819 patent could be employed to simultaneously remove H₂S and

mercury from any gas stream. The '743 patent more specifically does not teach or suggest that the catalysts of the '819 patent can be employed to remove H₂S and mercury from gas streams containing hydrogen and/or carbon monoxide.

In view of the foregoing, the rejection of claims 4 and 53 should be withdrawn.

Conclusion

The claims as amended are believed to be in condition for allowance and passage to issuance is respectfully requested. No fees for excess claims are believed due. This submission is accompanied by a Petition for Extension of Time and a check in the amount of \$225 for fees due.

It is believed no additional fees are required. If the enclosed amount is incorrect, please charge any deficiency or credit any overpayment to deposit account 07-1969.

Respectfully submitted,


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Amendments to the Drawings

The amendments to the drawings are illustrated in red in marked-up copies of the amended drawings which are each labeled "Annotated Sheet." Assuming that the drawing changes are acceptable, replacement sheets for Figures 1, 2 and 3 are submitted herewith which incorporate the drawing changes and which are each labeled "Replacement Sheet."

Figure 1 is amended to delete the box with text "Direct Oxidation Reactor." This deletion is made to improve the clarity of the drawing. The "catalytic reactor" labeled 415 is not the Direct Oxidation Reactor it is one element of the Direct Oxidation Reactor.

Figure 2 is amended to delete the text "Direct Oxidation Reactor" to improve clarity of the drawing. The "catalytic reactor" labeled 415 is not the Direct Oxidation Reactor, it is a portion of that reactor. The device elements that make up the "Direct Oxidation Reactor" are those that extend between the arms of the bracket which is labeled 501. The lead line from the catalytic reactor to number 415 has been lengthened.

Figure 3 is amended as suggested by the Examiner to insert the word "Inventive" in the text box labeled 601.

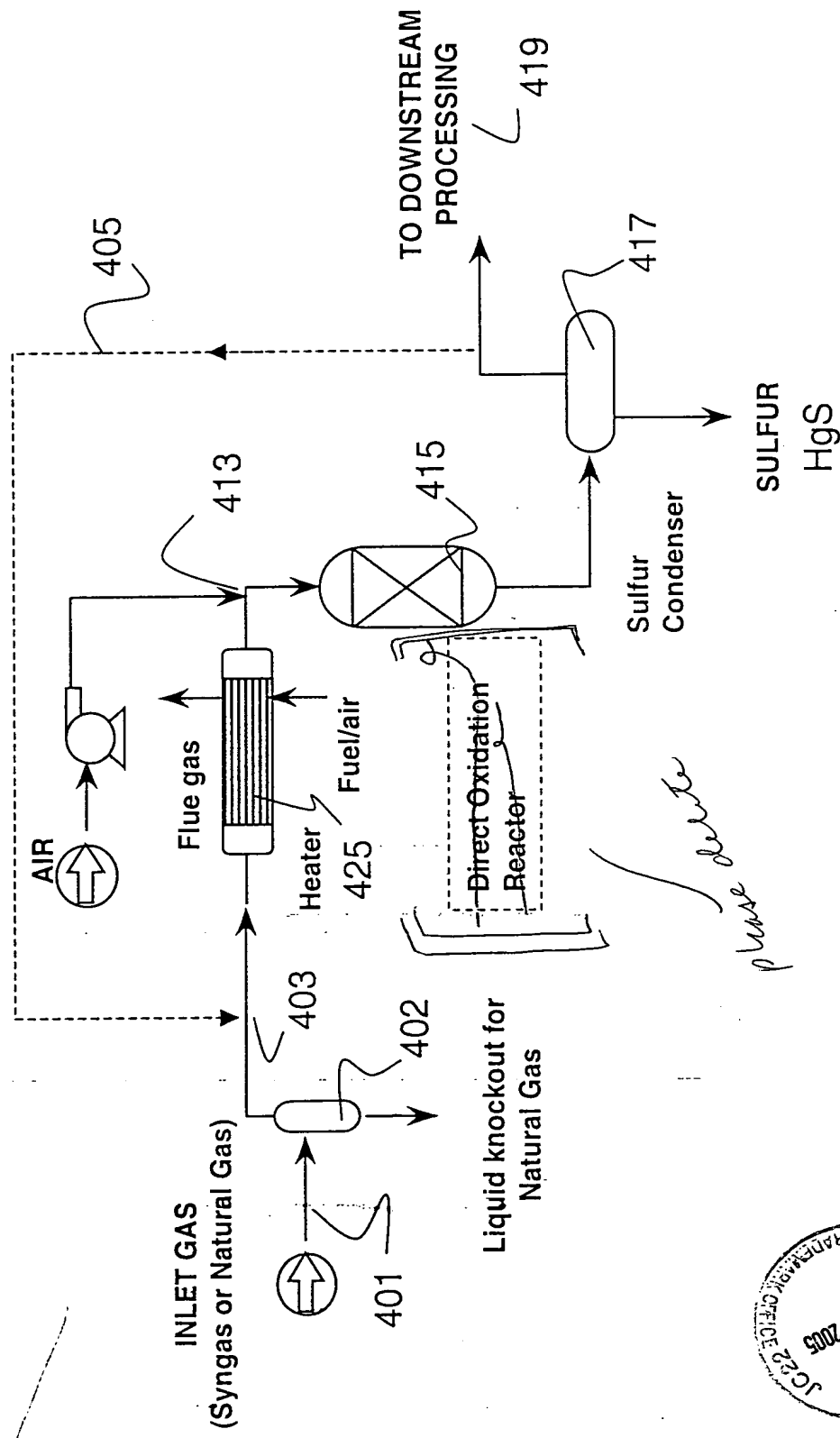
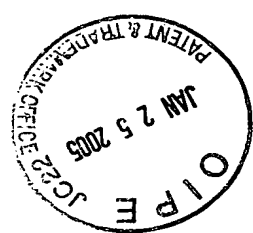


Fig. 1

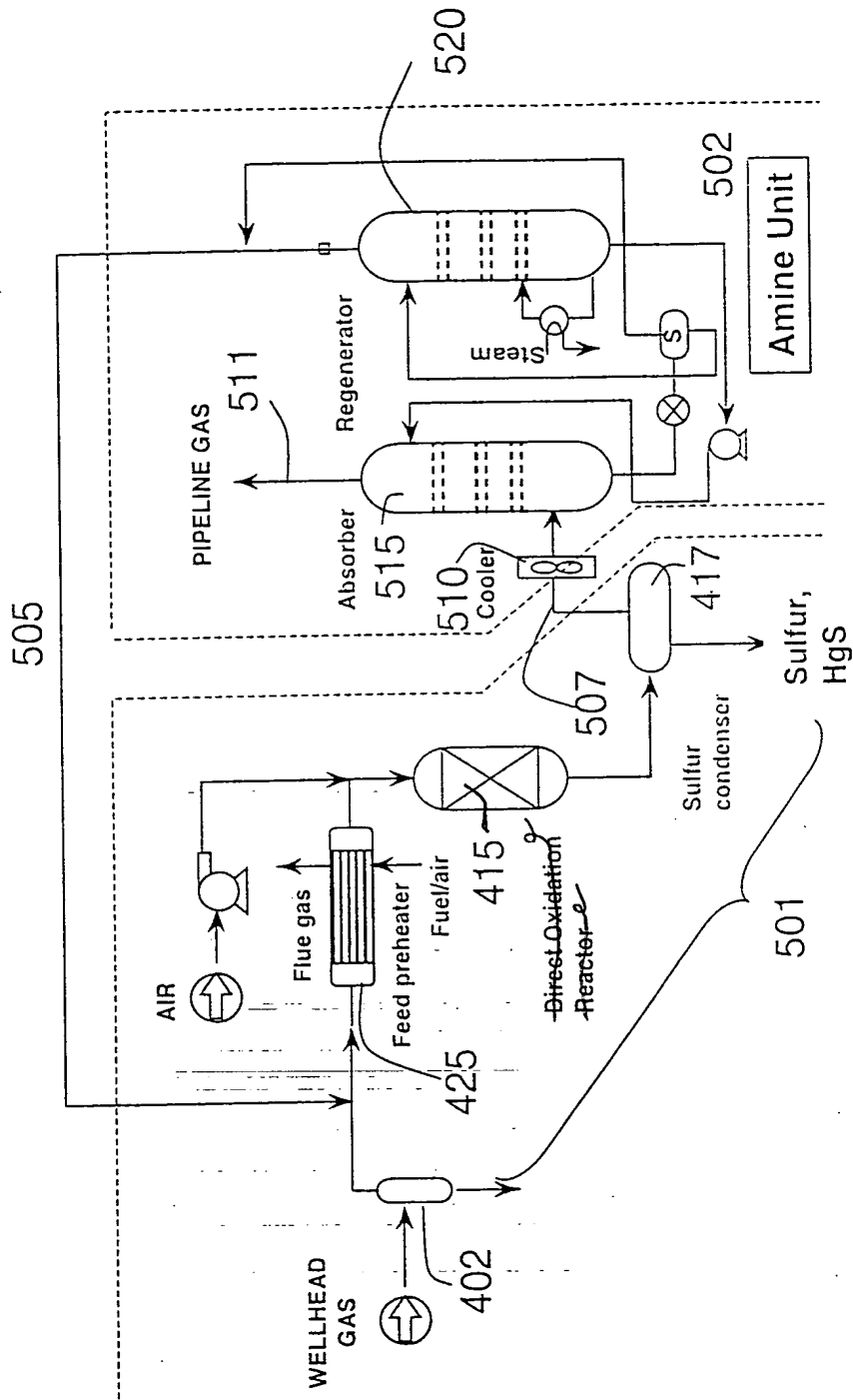


Fig. 2

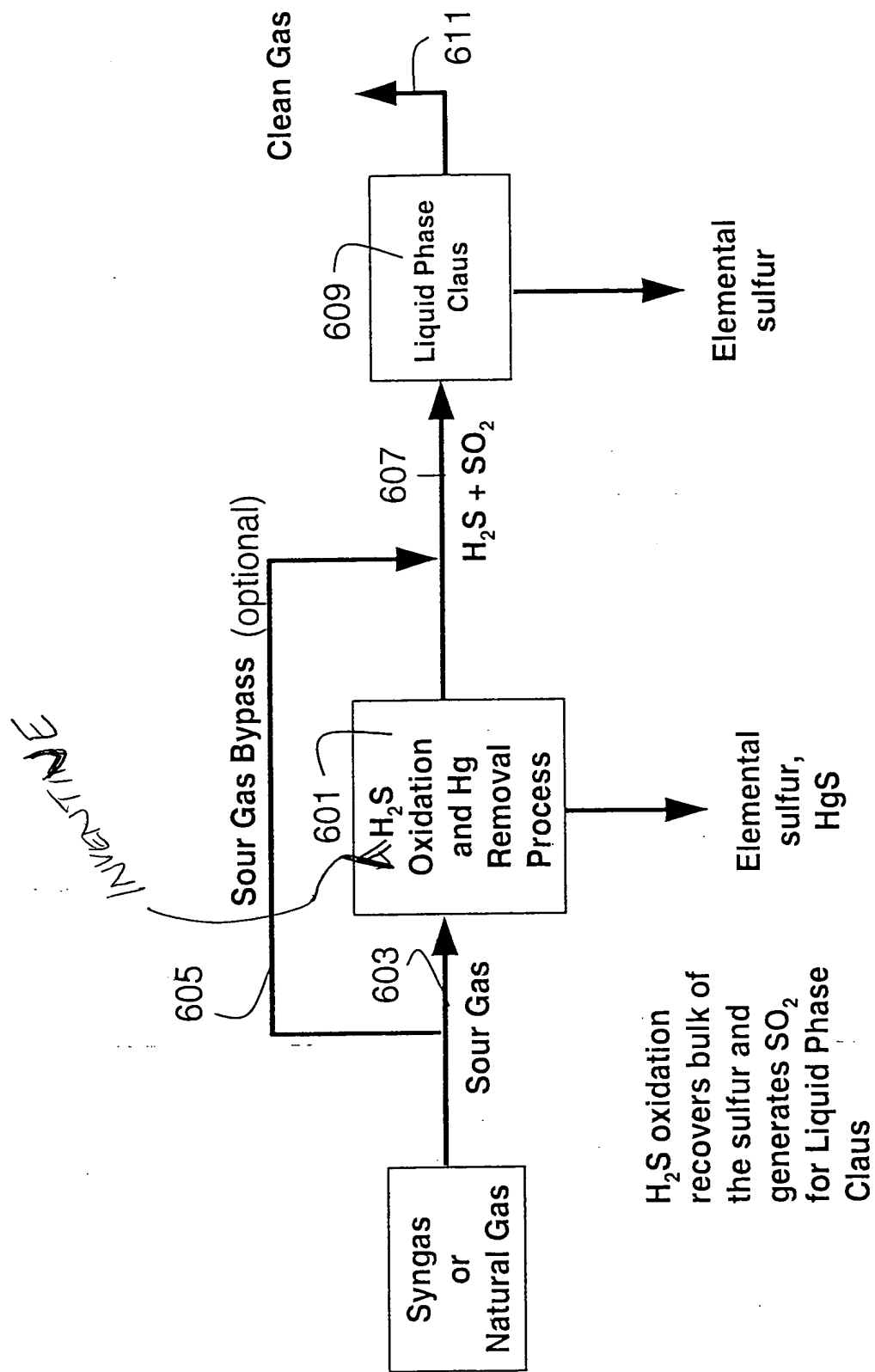


Fig. 3